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BUREAU OF MINES MINERALS YEARBOOK

# The Mineral Industry of the Philippines

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

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# The Mineral Industry of the Philippines

By Travis Q. Lyday[1]

After 3 consecutive years in which the nation's economy had a negative growth greater than 9%, the country's real gross domestic product (GDP) increased by an estimated 5.7% more than that of 1986, to $33.5 billion.[2] The mining industry continued to grow, spurred by favorable international prices for copper and gold as well as improved demand for construction-related industrial minerals, and represented an estimated 2% of the GDP.

The Philippines is rich in mineral resources. There are profuse deposits of gold, especially in Mountain and Camarines Norte Provinces on Luzon; copper in Zambales Province on Luzon and in the Visayan Islands; zinc at Zamboanga on Mindanao; high-grade chromium in Zambales and Camarines Sur Provinces on Luzon, near Surigao on Mindanao, and near Puerto Princesa on Palawan; and nickel at Hinatuan, Surigao del Norte Province on Mindanao. Deposits of cadmium, iron ore, lead, manganese, mercury, molybdenum, and silver also occur in the country. Deposits of industrial minerals include limestone for cement on Cebu, Luzon, and Romblon; salt and asbestos on Luzon; marble on Romblon and Panay; asphalt on Leyte; gypsum on Luzon; sulfur on Luzon, Leyte, and Mindanao; phosphate rock on Cebu and Bohol; and coal on Cebu and Palawan.

**Government Policies and Programs.**—Envisioning the importance of the role of mineral resources and the mineral industry to economic recovery and sustained growth of the country, the Government formulated a medium-term (5-year) mineral resources development plan for 1987-91. The plan, primarily developed by the Department of Environment, Energy and Natural Resources (DEENR), formerly the Department of Natural Resources, and its Mines and Geo-Sciences Bureau, formerly named the Bureau of Mines and Geo-Sciences, had several aims. They included promoting the efficient and judicial use of mineral resources; ensuring sustainable productive capacity of mineral resources; encouraging and supporting community-based (i.e., small-scale) mining, mineral resource management and conservation; achieving a more equitable sharing of benefits derived from the development of mineral resources; increasing the mineral sector's contributions toward the national effort directed toward poverty; and encouraging the use of modern mining technology to promote harmony with the environment.

The Government, through the DEENR and the Chamber of Mines of the Philippines, requested a United Nations consultant to advise on the drafting of a new mining code. Work on the new code was scheduled to begin in January 1988.

## PRODUCTION

According to the National Economic and Development Authority, the total value of mining output in the Philippines increased 13.6% in the first half of 1987 more than the same 1986 period, rising to about $290 million. Nearly 75% of the total mining output was accounted for by copper and gold, valued at about $211 million. The

value of mined gold, $128 million, increased 27%, almost entirely owing to a 24% rise in the average price of gold, while that of copper decreased 9% to about $83 million. The value of chromium production was about $94 million, a decrease of about 25%.

Except for chemical- and refractory-grade chromite, production of the major minerals in the Philippines continued to decline.

**Table 1.—Philippines: Production of mineral commodities[1]**

(Metric tons unless otherwise specified)

| Commodity[2] | 1983 | 1984 | 1985 | 1986[p] | 1987[e] |
|---|---|---|---|---|---|
| METALS | | | | | |
| Arsenic: White (equivalent of arsenic acid)[e] | -- | -- | 5,000 | 5,000 | 5,000 |
| Chromium: Chromite, gross weight: | | | | | |
| Metallurgical-grade | 136,347 | 123,015 | 122,359 | 85,271 | [3]69,429 |
| Chemical-grade | -- | 5,369 | 15,038 | 16,109 | [3]19,899 |
| Refractory-grade | 130,562 | 132,505 | 134,634 | 72,850 | [3]98,572 |
| Total | 266,909 | 260,889 | 272,031 | 174,230 | 187,900 |
| Cobalt, mine output, Co content | 165 | 64 | 911 | 92 | -- |
| Copper: | | | | | |
| Mine output, Cu content | 271,403 | 233,359 | 222,189 | 222,644 | [3]215,014 |
| Metal: | | | | | |
| Smelter | 57,600 | 109,200 | 133,800 | 124,300 | [3]124,700 |
| Refined | 38,800 | 99,230 | 130,227 | 134,547 | [3]132,118 |
| Gold, mine output, Au content—troy ounces | 816,536 | 827,149 | 1,062,149 | 1,296,367 | [3]1,352,934 |
| Iron and steel: | | | | | |
| Iron ore and concentrate—thousand tons | 3 | -- | -- | -- | -- |
| Ferroalloys: | | | | | |
| Electric-furnace ferrosilicon[e] | 20,000 | 18,400 | 20,000 | 20,000 | -- |
| Electric-furnace ferrochromium | 26,901 | 48,049 | 50,815 | [e]55,000 | 50,000 |
| Steel, crude—thousand tons | 200 | 250 | 250 | 250 | 250 |
| Manganese ore and concentrate, gross weight | 2,242 | 615 | 387 | 232 | [3]421 |
| Molybdenum, mine output, Mo content | 40 | -- | -- | -- | -- |
| Nickel: | | | | | |
| Mine output, Ni content | 13,900 | 13,601 | 28,158 | 12,790 | [3]7,818 |
| Metal, smelter | 6,097 | 3,528 | 16,993 | 2,076 | -- |
| Silver, mine output, Ag content—thousand troy ounces | 1,823 | 1,574 | 1,685 | 1,688 | [3]1,654 |
| Zinc, mine output, Zn content | 2,275 | 2,189 | 1,880 | 1,573 | [3]1,129 |
| INDUSTRIAL MINERALS | | | | | |
| Barite | 1,201 | 581 | -- | -- | -- |
| Cement, hydraulic—thousand tons | 4,383 | 3,651 | 3,080 | 3,457 | 3,000 |
| Clays: | | | | | |
| Bentonite | 670 | 38,249 | 24,971 | [e]20,000 | [3]759 |
| Red | 532 | 200 | -- | [e]300 | 300 |
| White | 19,990 | 8,618 | 6,093 | [e]7,000 | 7,000 |
| Other | 397,903 | 372,111 | 344,921 | [e]350,000 | [3]406,033 |
| Feldspar | 6,524 | 11,486 | 5,412 | [e]6,000 | 6,000 |
| Gypsum and anhydrite: | | | | | |
| Natural | 500 | 600 | 300 | [e]200 | 500 |
| Synthetic[e] | 110,000 | 112,000 | 112,000 | 112,000 | 112,000 |
| Lime | 50,675 | 50,711 | 47,427 | [e]45,000 | 45,000 |
| Magnesite | 620 | 625 | 676 | [e]650 | 650 |
| Nitrogen: N content of ammonia | 20,300 | 16,200 | [e]17,000 | [e]17,000 | 17,000 |
| Perlite | 2,020 | 15,641 | 3,883 | [e]3,500 | 4,000 |
| Phosphate: | | | | | |
| Guano | 610 | 552 | 1,229 | [e]1,000 | 1,000 |
| Phosphate rock | 4,135 | 7,488 | 6,392 | [e]6,000 | 8,000 |
| Pyrite and pyrrhotite (including cuprous), gross weight | 62,864 | 82,806 | 232,478 | 244,028 | [3]341,417 |
| Salt, marine | 381,912 | 401,008 | 421,058 | 785,354 | [3]446,532 |
| Sand and gravel: | | | | | |
| Silica sand—thousand tons | 408 | 432 | 317 | [e]400 | [3]351 |
| Other[4]—thousand cubic meters | 15,132 | 14,695 | 11,235 | [e]13,000 | [3]13,943 |
| Stone: | | | | | |
| Dacite | 32,448 | -- | -- | -- | -- |
| Diorite | 47,895 | -- | -- | -- | -- |
| Dolomite | 334,043 | 368,052 | 362,101 | [e]360,000 | 360,000 |
| Limestone[5]—thousand tons | 6,686 | 4,074 | 3,521 | [e]4,000 | 4,000 |
| Marble (dimension), unfinished—cubic meters | 6,117 | 4,919 | 4,010 | [e]5,000 | 5,000 |
| Volcanic cinder—do. | 482 | -- | 6,630 | [e]1,000 | 1,000 |
| Sandstone | 47,234 | 5,840 | -- | -- | -- |
| Tuff | 117,772 | 29,269 | 19,505 | [e]20,000 | -- |
| Quartz | 74,515 | 79,536 | 93,735 | [e]80,000 | 80,000 |
| Crushed, broken, other[e]—thousand cubic meters | 1,857 | 600 | 701 | [e]1,000 | 1,000 |
| Sulfur: S content of pyrite | 29,232 | 38,505 | 108,102 | 113,473 | 158,200 |
| Talc | 878 | 927 | 345 | [e]1,000 | -- |

See footnotes at end of table.

**Table 1.—Philippines: Production of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity[2] | 1983 | 1984 | 1985 | 1986[p] | 1987[e] |
|---|---|---|---|---|---|
| MINERAL FUELS AND RELATED MATERIALS | | | | | |
| Coal, all grades | 1,019,594 | 1,216,388 | 1,257,881 | 1,128,449 | [3]1,152,342 |
| Petroleum: | | | | | |
| Crude thousand 42-gallon barrels | 4,654 | 3,890 | 3,285 | 2,190 | 1,800 |
| Refinery products: | | | | | |
| Gasoline do. | 9,349 | 8,124 | [e]9,000 | [e]9,200 | 9,000 |
| Jet fuel do. | 3,007 | 3,322 | [e]3,000 | [e]3,000 | 3,000 |
| Kerosene do. | 3,441 | 2,382 | [e]2,500 | [e]2,700 | 2,500 |
| Distillate fuel oil do. | 17,540 | 17,027 | [e]17,000 | [e]17,300 | 17,000 |
| Residual fuel oil do. | 21,670 | 18,544 | [e]19,000 | [e]20,000 | 19,000 |
| Other do. | 5,097 | 4,027 | [e]4,500 | [e]4,800 | 4,500 |
| Refinery fuel and losses do. | 14,555 | [e]15,000 | [e]15,000 | [e]15,000 | 15,000 |
| Total do. | 74,659 | [e]68,426 | [e]70,000 | [e]72,000 | 70,000 |

[e]Estimated. [p]Preliminary.

[1]Table includes data available through July 12, 1988.

[2]In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metals, but output is not reported quantitatively, and no basis is available to make reliable estimates of output levels.

[3]Reported figure.

[4]Includes "pebbles" and "soil" not further described.

[5]Excludes limestone for road construction. Reported figures are as follows, in cubic meters: 1983—84,742; 1984—17,722; 1985—1,914; 1986—not available; and 1987—not available.

[6]Includes materials described as rock, crushed or broken; stones, cobbles, and boulders; rock aggregates; and broken adobe.

## TRADE

Minerals were among the Philippines top exports in 1987, and the mining industry was a major foreign-exchange earner. The country's mineral exports in 1987 were valued at $769 million, 2.6% more than the 1986 total, and represented about 15% of the country's total exports. The increase was primarily due to higher world metal prices. However, export volumes of major metals fell. The share of copper concentrate exports to total exports continued to decline as the Philippine Associated Smelting and Refining Corp. (PASAR) continued to take, by Government mandate, a larger share of the domestic copper production for in-country smelting. Shipments of copper concentrates dropped to 332,000 tons from 361,000 tons and copper cathodes to 105,000 tons from 127,000 tons. Gold shipments decreased to almost 1.08 million troy ounces from about 1.13 million troy ounces, and silver to 1.48 million troy ounces from 1.57 million troy ounces.

**Table 2.—Philippines: Exports and reexports of mineral commodities[1]**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Destinations, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| METALS | | | | |
| Aluminum: Metal including alloys, all forms | 28 | 56 | (2) | Japan 31; Australia 10. |
| Arsenic: Oxides and acids | 1,449 | 2,613 | 1,319 | United Kingdom 867; Australia 331. |
| Chromium: Ore and concentrate | 159,435 | 130,165 | 26,213 | Sweden 25,756; China 21,471. |
| Copper: | | | | |
| Ore and concentrate | 344,201 | 359,781 | -- | Japan 285,584; Republic of Korea 24,964. |
| Matte and speiss including cement copper | 7,004 | -- | | |
| Metal including alloys: | | | | |
| Scrap | 6,915 | 8,151 | -- | Singapore 5,000; Japan 1,354. |
| Unwrought | 129,901 | 130,228 | -- | Japan 41,072; Taiwan 38,320; Republic of Korea 28,840. |
| Semimanufactures | 2,797 | 5,235 | -- | Taiwan 2,347; Singapore 1,286; Japan 806. |
| Gold: Metal contained in copper concentrates troy ounces | [r]332,374 | 394,572 | -- | Japan 178,686; United Kingdom 62,975; France 62,492. |

See footnotes at end of table.

**Table 2.—Philippines: Exports and reexports of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Destinations, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| **METALS —Continued** | | | | |
| Iron and steel: | | | | |
| Iron ore and concentrate: | | | | |
| Excluding roasted pyrite: | | | | |
| Agglomerated thousand tons | 4,022 | 3,587 | 115 | Japan 3,472. |
| Not agglomerated | 12,000 | 16,552 | -- | All to Japan. |
| Pyrite, roasted | 11,751 | 7,917 | -- | Taiwan 4,300; Japan 3,617. |
| Metal: | | | | |
| Scrap | 952 | 849 | 19 | Japan 784. |
| Ferroalloys: | | | | |
| Ferrosilicon | 22,428 | 10,079 | -- | Japan 7,101; Indonesia 1,004; Taiwan 876. |
| Unspecified | 50,379 | 55,970 | -- | Japan 40,745; Netherlands 4,200. |
| Steel, primary forms | 10 | -- | | |
| Semimanufactures: | | | | |
| Bars, rods, angles, shapes, sections | 84 | 110 | 61 | Sri Lanka 12. |
| Universals, plates, sheets | 118 | 16 | -- | Guam 6; China 4. |
| Hoop and strip | (2) | -- | | |
| Wire | 1 | 7 | -- | All to Pacific Islands Trust Territory. |
| Tubes, pipes, fittings | 3,249 | 525 | 351 | Australia 50; Singapore 49. |
| Castings and forgings, rough | 497 | 408 | 151 | Australia 214. |
| Magnesium: Metal including alloys, all forms | 19 | 20 | | All to Japan. |
| Manganese: Ore and concentrate | -- | 216 | -- | Do. |
| Nickel: | | | | |
| Ore and concentrate | 616,455 | 420,809 | -- | Do. |
| Metal including alloys: | | | | |
| Unwrought | 11,284 | 2,566 | 300 | Switzerland 950; Republic of Korea 612; Japan 389. |
| Semimanufactures | 2,652 | 1,604 | 300 | Japan 1,260. |
| Silver: Metal including alloys, unwrought and partly wrought troy ounces | r497,566 | 708,034 | 13,125 | France 248,154; United Kingdom 240,684; West Germany 162,268. |
| Tin: Metal including alloys, all forms | 21 | 15 | 4 | Japan 11. |
| Tungsten: Metal including alloys, all forms | 2 | 4 | 4 | |
| Zinc: | | | | |
| Ore and concentrate | 4,487 | 3,404 | -- | All to Japan. |
| Metal including alloys, all forms | r188 | 304 | -- | Taiwan 196; Japan 108. |
| Other: | | | | |
| Oxides and hydroxides | 77 | 109 | 10 | Netherlands 64; United Kingdom 16. |
| Ashes and residues | 8,488 | 8,467 | -- | Singapore 6,082; Japan 1,547. |
| Base metals including alloys, all forms | 693 | 688 | 154 | Japan 255; Hong Kong 103; Taiwan 93. |
| **INDUSTRIAL MINERALS** | | | | |
| Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc | 101 | 634 | -- | Hong Kong 313; Taiwan 301. |
| Asbestos, crude | -- | 360 | -- | Indonesia 300; Pakistan 60. |
| Cement | 370,828 | 105,366 | -- | Bangladesh 73,762; China 30,000. |
| Clays, crude | 40,901 | 10 | -- | All to Sri Lanka. |
| Feldspar, fluorspar, related materials | 536 | -- | | |
| Fertilizer materials: | | | | |
| Crude, n.e.s | 1,627 | 1,173 | -- | Taiwan 896; West Germany 242. |
| Manufactured: | | | | |
| Nitrogenous | 3,170 | 13,790 | -- | Australia 6,568; Thailand 2,947; Indonesia 2,558. |
| Phosphatic | 158,304 | 544,503 | -- | China 243,564; Iran 110,411; Ethiopia 76,326. |
| Unspecified and mixed | 31,004 | 30,614 | -- | China 30,577. |
| Gypsum and plaster | -- | 5,250 | -- | All to Japan. |
| Lime | -- | 12 | -- | All to Guam. |
| Mica: Crude including splittings and waste kilograms | -- | 500 | -- | All to Indonesia. |
| Phosphates, crude | -- | 600 | -- | All to Taiwan. |
| Pigments, mineral: Natural, crude | 3 | 1 | -- | All to Guam. |
| Salt and brine | (2) | 1 | 1 | |
| Stone, sand and gravel: | | | | |
| Dimension stone: | | | | |
| Crude and partly worked | 4,161 | 4,094 | -- | Japan 3,141; Taiwan 622. |
| Worked | 3,345 | 2,136 | 614 | Australia 398; Guam 323; Hong Kong 311. |
| Dolomite, chiefly refractory-grade | 327,230 | 271,247 | -- | All to Japan. |
| Gravel and crushed rock | 12,668 | 15,114 | 14 | Japan 10,996; Hong Kong 3,069. |

See footnotes at end of table.

**Table 2.—Philippines: Exports and reexports of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Destinations, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| INDUSTRIAL MINERALS —Continued | | | | |
| Stone, sand and gravel —Continued | | | | |
| Limestone other than dimension | 3,750 | 39,954 | -- | Taiwan 21,759; Japan 13,745. |
| Sand other than metal-bearing | 2,113 | 2,668 | 796 | Japan 601; Hong Kong 420; United Kingdom 316. |
| Sulfur: | | | | |
| Elemental: Colloidal, precipitated, sublimed kilograms | -- | 20 | -- | All to Thailand. |
| Sulfuric acid | 20,214 | -- | | |
| Other: | | | | |
| Crude | 233 | 2,198 | -- | Taiwan 1,841. |
| Slag and dross, not metal-bearing | 1,222 | 480 | -- | All to Japan. |
| MINERAL FUELS AND RELATED MATERIALS | | | | |
| Asphalt and bitumen, natural | 18 | 18 | -- | All to Hong Kong. |
| Carbon black | 1,372 | 1,477 | -- | Thailand 986; Taiwan 398. |
| Petroleum refinery products: | | | | |
| Liquefied petroleum gas 42-gallon barrels | 655,504 | 868,457 | -- | Hong Kong 612,190; Malaysia 98,588; Thailand 67,585. |
| Naphtha including white spirit do. | 580,644 | 1,864,314 | -- | Japan 899,402; Taiwan 456,204. |
| Kerosene and jet fuel do. | -- | 335,592 | -- | All to Japan. |
| Lubricants do. | 10,333 | 9,999 | -- | Taiwan 4,512; Republic of Korea 2,362. |
| Residual fuel oil do. | -- | 441,611 | -- | Hong Kong 227,845; Guam 213,699. |

[r] Revised.
[1] Table prepared by Audrey D. Wilkes.
[2] Less than 1/2 unit.

**Table 3.—Philippines: Imports of mineral commodities[1]**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Sources, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| METALS | | | | |
| Alkali and alkaline-earth metals kilograms | 3,463 | 1,812 | -- | United Kingdom 995; Japan 765. |
| Aluminum: | | | | |
| Ore and concentrate | 5,005 | 5,379 | 39 | Malaysia 4,861; China 400. |
| Oxides and hydroxides | 3,532 | 5,380 | 108 | Japan 4,084; Australia 630. |
| Metal including alloys: | | | | |
| Scrap | 144 | 345 | 58 | Hong Kong 270. |
| Unwrought | 4,881 | 6,271 | 38 | Australia 3,754; Canada 1,328. |
| Semimanufactures | 6,419 | 6,445 | 123 | Japan 1,795; Republic of Korea 1,040; Singapore 905. |
| Arsenic: Oxides and acids | 14 | 16 | -- | All from Malaysia. |
| Chromium: | | | | |
| Ore and concentrate | 29,947 | 17 | -- | Japan 12. |
| Oxides and hydroxides | 76 | 27 | 18 | West Germany 7. |
| Cobalt: Oxides and hydroxides kilograms | 4,750 | 1,231 | 45 | Belgium-Luxembourg 500; Canada 400. |
| Copper: | | | | |
| Sulfate | 95 | 245 | -- | Taiwan 167; West Germany 49. |
| Metal including alloys: | | | | |
| Scrap | -- | 16 | -- | All from Japan. |
| Unwrought | 5 | 8 | -- | Mainly from Japan. |
| Semimanufactures | 2,615 | 3,241 | 824 | Japan 1,687; Republic of Korea 422. |
| Gold: Metal including alloys, unwrought and partly wrought troy ounces | 8,583 | 9,571 | 6,244 | Singapore 1,853. |
| Iron and steel: | | | | |
| Iron ore and concentrate excluding roasted pyrite, not agglomerated thousand tons | [r]3,389 | 2,575 | -- | Brazil 1,157; Australia 1,087. |

See footnote at end of table.

**Table 3.—Philippines: Imports of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Sources, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| METALS —Continued | | | | |
| Iron and steel —Continued | | | | |
| Metal: | | | | |
| Scrap | 751 | 85,243 | 38,878 | United Kingdom 20,553; Canada 19,826. |
| Pig iron, cast iron, related materials | 329 | 22,366 | 24 | Malaysia 21,989. |
| Ferroalloys: | | | | |
| Ferromanganese | 591 | 1,431 | 22 | Netherlands 324; Mozambique 260; Taiwan 210. |
| Unspecified | 68 | 292 | 3 | Japan 77; China 50; Taiwan 40. |
| Steel, primary forms | 238,542 | 391,367 | 1,643 | Brazil 150,040; Republic of Korea 119,389. |
| Semimanufactures: | | | | |
| Bars, rods, angles, shapes, sections | 35,944 | 37,685 | 184 | Japan 22,581; Republic of Korea 6,625. |
| Universals, plates, sheets | 97,058 | 199,923 | 8,813 | Japan 156,469. |
| Hoop and strip | 4,403 | 4,495 | 94 | Japan 3,854. |
| Rails and accessories | 1,301 | 384 | 5 | Japan 174; Republic of Korea 123. |
| Wire | 5,981 | 7,128 | 63 | Japan 3,541; Republic of Korea 2,334. |
| Tubes, pipes, fittings | 13,518 | 12,445 | 418 | Japan 8,453; Republic of Korea 2,008. |
| Lead: | | | | |
| Oxides | 12 | 12 | 5 | Australia 5. |
| Metal including alloys: | | | | |
| Scrap | 3,600 | 4,307 | 39 | Australia 4,116. |
| Unwrought | 2,984 | 4,532 | 68 | Australia 1,806; Taiwan 1,506; Japan 1,078. |
| Semimanufactures | 189 | 197 | 52 | Australia 89; Japan 27. |
| Magnesium: Metal including alloys, all forms | 69 | 36 | 1 | Hong Kong 28. |
| Manganese: | | | | |
| Ore and concentrate, metallurgical-grade | 2,669 | 3,040 | -- | Singapore 2,159; Japan 799. |
| Oxides | 916 | 874 | 11 | Japan 756; Australia 80. |
| Mercury 76-pound flasks | 886 | 1,596 | (2) | Algeria 490; China 429; West Germany 300. |
| Molybdenum: Metal including alloys, all forms | 20 | 2 | 1 | Netherlands 1. |
| Nickel: Metal including alloys: | | | | |
| Unwrought | 28 | 50 | 10 | Japan 19; Hong Kong 13. |
| Semimanufactures | 160 | 68 | 5 | West Germany 24; Austria 12; Japan 11. |
| Platinum-group metals: Metals including alloys, unwrought and partly wrought troy ounces | 801 | 387 | 386 | West Germany 1. |
| Silver: Metal including alloys, unwrought and partly wrought do. | 1,291 | 885 | 810 | United Kingdom 75. |
| Tin: | | | | |
| Oxides kilograms | 95 | -- | -- | |
| Metal including alloys, all forms | 362 | 527 | (2) | Indonesia 409. |
| Titanium: | | | | |
| Ore and concentrate | 487 | 966 | -- | Australia 802; Mozambique 108. |
| Oxides | 794 | 1,505 | 24 | Japan 544; United Kingdom 461. |
| Tungsten: Metal including alloys, all forms | 11 | 8 | (2) | Belgium-Luxembourg 7. |
| Uranium and/or thorium: Oxides and other compounds kilograms | 500 | -- | | |
| Zinc: | | | | |
| Oxides | 399 | 379 | 56 | Taiwan 129; Republic of Korea 64. |
| Blue powder | 189 | 168 | 143 | Australia 15. |
| Metal including alloys: | | | | |
| Unwrought | 13,000 | 18,897 | 102 | Japan 5,452; Australia 5,061; Canada 3,461. |
| Semimanufactures | 31 | 27 | 18 | Hong Kong 6. |
| Zirconium: Ore and concentrate | 22 | 41 | -- | Mainly from Australia. |
| Other: | | | | |
| Ores and concentrates | -- | 7 | 7 | |
| Oxides and hydroxides | 4,135 | 5,386 | -- | China 3,558; United Kingdom 721. |
| Ashes and residues | 79,791 | 38,535 | 76 | Japan 38,422. |
| Base metals including alloys, all forms | 35 | 30 | 10 | China 16. |
| INDUSTRIAL MINERALS | | | | |
| Abrasives, n.e.s.: | | | | |
| Natural: Corundum, emery, pumice, etc | 338 | 244 | 23 | Chile 90; Netherlands 64; Hong Kong 51. |

See footnotes at end of table.

**Table 3.—Philippines: Imports of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Sources, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| INDUSTRIAL MINERALS —Continued | | | | |
| Abrasives, n.e.s. —Continued | | | | |
| Artificial: | | | | |
| Corundum | 27 | 68 | -- | Australia 54. |
| Silicon carbide | 126 | 51 | 3 | West Germany 18; Brazil 17. |
| Dust and powder of precious and semi-precious stones including diamond grams | 440 | 150 | -- | All from Austria. |
| Grinding and polishing wheels and stones | 520 | 788 | 8 | Hong Kong 291; Taiwan 107; China 80. |
| Asbestos, crude | 1,190 | 1,151 | 305 | Canada 726; U.S.S.R. 102. |
| Barite and witherite | 1,247 | 43 | 21 | China 20. |
| Boron materials: Oxides and acids | 124 | 174 | 72 | Italy 36; France 34. |
| Bromine including fluorine and iodine | 4 | 4 | (2) | West Germany 2. |
| Cement | 736 | 14,033 | 775 | Republic of Korea 11,249; China 1,500. |
| Chalk | 31 | 24 | -- | West Germany 22. |
| Clays, crude | 19,924 | 19,291 | 6,963 | Thailand 2,136; Hong Kong 1,790; Malaysia 1,582. |
| Cryolite and chiolite kilograms | -- | 500 | -- | All from Switzerland. |
| Diamond: Industrial stones, natural carats | 178,802 | 1,067,311 | -- | Belgium-Luxembourg 1,062,711. |
| Diatomite and other infusorial earth | 148 | 407 | 143 | Japan 224. |
| Feldspar, fluorspar, related materials | 1,633 | 1,535 | 31 | Thailand 500; China 354; Japan 183. |
| Fertilizer materials: | | | | |
| Crude, n.e.s | -- | 12 | 12 | |
| Manufactured: | | | | |
| Ammonia | 184,311 | 139,254 | 1,018 | Indonesia 87,058; Qatar 15,941. |
| Nitrogenous | 377,141 | 720,402 | 3 | Indonesia 297,430; Japan 111,626; Kuwait 81,554. |
| Phosphatic | 4,196 | 760 | -- | All from West Germany. |
| Potassic | 58,268 | 86,590 | 4 | Canada 22,000; Republic of Korea 14,901; Israel 11,000. |
| Unspecified and mixed | 205,909 | 52,860 | 20 | Republic of Korea 51,400. |
| Graphite, natural | 73 | 122 | 1 | Sri Lanka 40; China 24; Hong Kong 20. |
| Gypsum and plaster | 130,627 | 150,984 | 162 | Indonesia 70,542; Thailand 16,070. |
| Lime | 330 | 431 | 386 | United Kingdom 45. |
| Magnesium compounds: Magnesite, crude including calcined | 5,651 | 8,375 | 36 | China 5,046; Japan 2,769. |
| Mica, all forms | 31 | 112 | 40 | West Germany 36; India 20. |
| Nitrates, crude | -- | 74 | -- | All from Belgium-Luxembourg. |
| Phosphates, crude thousand tons | 306 | 1,287 | 97 | Nauru 714; Morocco 383; Senegal 84. |
| Pigments, mineral: | | | | |
| Natural, crude | 1,843 | 3,106 | 83 | India 2,789. |
| Iron oxides and hydroxides, processed | 696 | 871 | 68 | West Germany 603; Spain 97. |
| Salt and brine | 71,130 | 88,917 | 124 | Australia 44,454; China 37,411; West Germany 5,311. |
| Sodium compounds, n.e.s.: | | | | |
| Carbonate, natural and manufactured | 66,833 | 71,229 | 37,152 | Kenya 18,162; Japan 14,914. |
| Sulfate, manufactured | 9,519 | 14,730 | 36 | China 10,299; Taiwan 3,195. |
| Stone, sand and gravel: | | | | |
| Dimension stone: | | | | |
| Crude and partly worked | 105 | 154 | -- | Hong Kong 84; Taiwan 46; China 24. |
| Worked | (2) | 16 | -- | Italy 15. |
| Dolomite, chiefly refractory-grade | 2,455 | 1,271 | -- | United Kingdom 973; West Germany 135; Taiwan 122. |
| Gravel and crushed rock | 617 | 214 | 1 | France 174; Japan 34. |
| Limestone other than dimension | 229 | 1,695 | -- | Taiwan 1,500. |
| Quartz and quartzite | 43 | 2 | -- | All from Netherlands. |
| Sand other than metal-bearing | 5,357 | 11,689 | 85 | Australia 11,109; Taiwan 460. |
| Sulfur: | | | | |
| Elemental: | | | | |
| Crude including native and by-product | 309 | 2,015 | 130 | Thailand 872; China 300; Japan 278. |
| Colloidal, precipitated, sublimed | 20,382 | 17,318 | 5,236 | Canada 6,247; Singapore 4,369. |
| Dioxides | 1 | 1 | -- | All from Netherlands. |
| Sulfuric acid | 30,392 | 123,407 | (2) | Japan 123,373. |
| Talc, steatite, soapstone, pyrophyllite | 5,620 | 7,147 | 694 | Republic of Korea 3,802; China 1,135. |

See footnotes at end of table.

**Table 3.—Philippines: Imports of mineral commodities[1] —Continued**

(Metric tons unless otherwise specified)

| Commodity | 1985 | 1986 | Sources, 1986 | |
|---|---|---|---|---|
| | | | United States | Other (principal) |
| INDUSTRIAL MINERALS —Continued | | | | |
| Other: | | | | |
| Crude | 257 | 359 | 1 | Japan 192; Australia 164. |
| Slag and dross, not metal-bearing | 54,357 | 80,017 | 1 | India 63,344; Taiwan 11,160; Japan 5,511. |
| MINERAL FUELS AND RELATED MATERIALS | | | | |
| Asphalt and bitumen, natural | 98 | 50 | -- | Republic of Korea 34; Singapore 16. |
| Carbon black | 14,306 | 764 | 85 | Taiwan 233; Singapore 201. |
| Coal, all grades including briquets | 1,152,747 | 960,308 | 58 | Australia 692,644; Indonesia 92,267; U.S.S.R. 67,225. |
| Coke and semicoke | 86,926 | 85,134 | 7,018 | Japan 63,293; U.S.S.R. 14,800. |
| Petroleum: | | | | |
| Crude thousand 42-gallon barrels | [r]47,114 | 49,391 | -- | Saudi Arabia 13,100; Malaysia 9,936; Kuwait 6,797. |
| Refinery products: | | | | |
| Gasoline do. | 26 | 25 | (2) | Mainly from Australia. |
| Mineral jelly and wax do. | 57 | 54 | 5 | China 36. |
| Distillate fuel oil do. | 4,459 | 6,285 | 312 | Taiwan 1,560; Republic of Korea 1,445; Singapore 1,422. |
| Lubricants do. | 51 | 46 | 9 | West Germany 9; Singapore 7. |
| Residual fuel oil do. | 38 | 13 | (2) | Mainly from Singapore. |

[r]Revised.
[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.

## COMMODITY REVIEW

### METALS

**Chromium.**—The chromium industry in the Philippines continued to stabilize during 1987, although ore production was estimated to have remained about the same as in 1986. Ore buyers remained uneasy, however, over the nation's long-range supply capability of chromium. Mines were being depleted while no new reserves were being developed and no new investments were being made.

The Philippines produced chemical-, metallurgical-, and refractory-grade chromite and ranked as the world's sixth largest producer. The largest producer of metallurgical-grade chromite, Acoje Mining Co. Inc. at Santa Cruz on Luzon Island, was faltering at yearend with heavy losses and unpaid loans. Voest-Alpine AG of Austria, the company's major shareholder, sold its holdings to Independent Resources of Australia, Minimax Exploration Co., and to private interests late in the year. Benguet Corp. was the largest miner of refractory-grade chromite, producing from its Masinloc Mine, Zambales Province, Luzon Island. Alamag Processing Corp., a joint venture of Rio Chico Mining Corp. of the Philippines and Bayer AG of the Federal Republic of Germany, produced chemical-grade chromite from its mines in eastern Samar Province.

Ferrochrome Philippines Inc. (FPI) was the largest producer of ferrochromium in the Philippines, operating the 60,000-ton-per-year-capacity plant at Tagoloan, near Cagayan de Oro, in northern Mindanao. Downtime for relining the sintering kiln and repairing a broken electrode resulted in an estimated production of 47,000 tons of high-carbon ferrochromium, lower than in previous years. Pacific Chrome Inc. held an option to take over Electro Alloys Inc. at Iligan City, Mindanao, to produce ferrochromium. A drawback to the takeover was that the Philippines could not supply the raw materials for the production of the target

18,000 tons of ferrochromium per year. Alternative sources were being considered at yearend, including India, Madagascar, New Caledonia, and the Republic of South Africa.

**Copper.**—PASAR—which was owned by the state-owned National Development Corp., 40%; a Japanese consortium led by Marubeni Corp., 32%; local copper producers led by Atlas Consolidated Mining and Development Corp., 23%; and International Finance Corp., 5%—was planning to increase production by 25% at its 138,000-ton-per-year smelter at Isabel in the central Province of Leyte. This increased output would lower unit production costs, take advantage of the shortfall of refined copper during the year, and diversify the company's sources of copper concentrates. Cost of the expansion was estimated to be $51 million. PASAR would have to import copper concentrate, since local mining firms had contract commitments with Japanese and other foreign smelters. The new smelter would require about 480,000 tons of copper concentrate when operating at full capacity.

At midyear, PASAR tested the feasibility of importing 50,000 tons of copper concentrate per year from Papua New Guinea. In June, DEENR gave approval to import 40,000 tons of concentrates from Papua New Guinea for the balance of 1987, marking the Philippines first imports of copper concentrates. At yearend, the company received approval to import 120,000 tons from Papua New Guinea in 1988. Sufficient concentrate from Papua New Guinea's two copper mines, Ok Tedi and Bougainville, would bring PASAR's capacity utilization to 98.5% compared with only 57% that could be supplied from existing Philippine mines.

The PASAR smelter was reportedly shut down for about a week in March owing to power problems, and some delay in cathode shipments was experienced. According to one report, some customers of PASAR were refusing shipments of copper cathode because of a quality-control problem.[3]

Galactic Resources Ltd. of Canada and Lepanto Consolidated Mining Co. Inc. announced near yearend a 40-60 joint venture to develop a major copper-gold mine, the Far South East Deposit, at Mankayan in Benguet Province. (See the "Gold" section for additional information.) Drilling by Lepanto Consolidated outlined 292 million tons of ore containing about 2 million tons of copper. J. S. Redpath Corp. of the United States and Kilborn Engineering Ltd. of Canada were to complete a feasibility study in early 1988.

Bond Corp. Holdings Ltd. of Australia and Atlas Consolidated, the Philippines largest mining firm, continued negotiations during the year on an agreement by Bond to assume Atlas Consolidated's existing loans and their restructuring into a gold loan; to acquire a 40% equity in Atlas Consolidated; and to extend a loan to Atlas Consolidated for the exploration and development of the Masbate gold mine on Masbate Island. By yearend, Atlas Consolidated's creditors had agreed in principle that Bond should assume Atlas Consolidated's debts. However, repayment was to be in gold rather than dividends, thereby creating an additional problem for the discussions. Under Philippine law, gold produced in the Philippines must be declared and sold to the Central Bank of the Philippines.

The Philippines ranked 10th among world copper producers. According to the Chamber of Mines of the Philippines, production of copper, by company, was as follows in metric tons:[4]

| Company | 1986 | 1987 |
|---|---|---|
| Atlas Consolidated Mining and Development Corp | 69,660 | 81,049 |
| Maricalum Mining Corp | 42,210 | 40,606 |
| Marcopper Mining Corp | 28,851 | 23,933 |
| Philex Mining Corp | 27,482 | 23,618 |
| Benguet Corp | 23,151 | 19,153 |
| North Davao Mining Corp | 16,863 | 13,671 |
| Lepanto Consolidated Mining Co. Inc | 13,011 | 12,985 |
| Benguet Exploration Inc.[1] | 1,416 | -- |
| Total | 222,644 | 215,015 |

[1]Copper production from the Copper Shield project was shut down in Sept. 1986.

**Gold.**—The Far South East Deposit, a major copper-gold porphyry deposit has indicated reserves, as developed by exploratory diamond drilling, of 12 million troy ounces of gold and an equal quantity of recoverable silver. (See the "Copper" section for additional information.) Galactic Resources was to contribute $2.4 million as part of the initial capitalization to fund a feasibility study. The total cost of the project was estimated to be $180 million.

Cultus Gold NL was making a surface exploration on its claims at Paracale Nationale in Bicol Province at yearend. The properties contain a former producing mine, and the company was resampling and

retrenching to determine both underground reserves and reserves amenable to surface mining. Cultus was also sampling and mapping three other properties in the area.

Kenmare Resources Pty. Ltd. Co. of Ireland initiated a major exploration program for epithermal gold on the islands of Leyte, Luzon, and Negros in September. The program, including geochemical assays on stream sediment and bedrock samples and heavy-mineral panning, was in joint venture with the Philippine National Oil Corp. (PNOC), each with a 40% stake, and private investors (20%). In addition, Kenmare was investigating in its own right two other prospects: Mount Bagacay, a prominent volcano near the southern edge of the Paracale gold district in Camarines Norte, and Mount Sembrano, a volcanic zone 40 kilometers east of Manila containing old gold workings.

Paragon Resources Ltd. acquired a 40% interest in the Longos Mine, formerly known as the Philippine Eagle Mine, in the Paracale District at the beginning of 1987. Private interests, who purchased the mine in the early 1980's and developed the property for production in 1982, held the remaining interest. Initial production, expected to begin at yearend, was projected at about 37,800 troy ounces of gold per year. Ore reserves were 1.8 million tons grading 0.28 troy ounce of gold per ton. Assets at the mine included head frames and winders, mining and milling equipment, and a concentrator and cyanide plant with a capacity to treat 15,000 tons of ore per year. Apparently, except for dewatering, the mine was virtually ready to produce as soon as agreements between the partners could be finalized. However, Paragon was conducting further exploration work and refurbishing the mill to produce at the rate of 150,000 tons of ore per year. The Philippine Eagle closed in 1952 because of low gold prices. Exploration below the old underground workings, done by Metals Exploration (Asia) Inc. in 1970 indicated minable reserves of 1.35 million tons of ore grading 13.57 grams of gold per ton. During the 1987 exploration of the site, Paragon established a high-grade open pit resource containing an indicated 800,000 tons of ore at a grade of 13 grams of gold per ton to a depth of 122 meters.

Gold production in the Philippines was ranked ninth in the world in 1987, dropping one place from the 1986 ranking. According to the Chamber of Mines of the Philippines, gold production by companies and small-scale gold panners was as follows, in troy ounces:[e]

| Company | 1986 | 1987 |
|---|---|---|
| Benguet Corp. (primary and by-product) | 246,100 | 249,137 |
| Philex Mining Corp. (byproduct) | 214,786 | 158,068 |
| Atlas Consolidated Mining and Development Corp. (primary and by-product) | 139,415 | 139,846 |
| Lepanto Consolidated Mining Co. Inc. (byproduct) | 69,996 | 73,373 |
| Apex Mining Co. Inc. (primary) | 43,476 | 44,962 |
| Surigao Consolidated Mining Co. (primary) | 34,717 | 39,596 |
| Marcopper Mining Corp. (byproduct) | 18,775 | 19,091 |
| Benguet Exploration Inc. (primary and byproduct) | 10,837 | 11,368 |
| Itogon-Suyoc Mines Inc. (primary) | 15,640 | 11,115 |
| Maricalum Mining Corp. (byproduct) | 9,366 | 9,287 |
| North Davao Mining Corp. (by-product) | 11,828 | 9,212 |
| Manila Mining Corp. (primary) | 7,628 | 8,086 |
| Small-scale gold panners[e] | 432,300 | 500,000 |
| Total | 1,296,406 | 1,273,111 |

[e]Estimated.

**Nickel.**—At yearend, Pacific Metals Co. of Japan, a Japanese ferronickel producer, imported from the newly opened Taganito Mine in northern Mindanao, the first shipment of 25,000 tons of nickel ore for testing purposes. The mine was opened in late 1987 on an exploratory basis, and was reported to have large resources averaging more than 2.4% nickel. Reportedly, Pacific Metals was planning to import 70,000 to 80,000 tons of nickel ore annually until the mine was fully developed.[9]

Nonoc Mining and Industrial Corp. (NMIC) pursued efforts to reopen its mine and refinery in Surigao, shut down since March 1986 by a labor strike and pervasive financial difficulties. NMIC was believed to have approached the leading South Korean steel company, Pohang Iron and Steel Co., for $30 million in aid. Reportedly, NMIC's creditors were approached by the Soviet metal trading and equipment company, Tsvetmetpromexport, for help in rehabilitating and operating NMIC.[7] Although the details of possible Soviet involvement was unknown at yearend, indications were that the U.S.S.R. was offering foreign investment, or equipment and spare parts, or personnel, technical assistance, and training in a barter arrangment for nickel or copper products. To resume operations, NMIC was believed to need more than $20 million to cover back wages for the workers, installation of a cable belt conveyor, spare parts and plant rehabilitation, and rebuild the inventory. NMIC filed a petition on

February 27 with the Government to stop a series of legal actions against the firm and to protect its dwindling assets. The refinery had an effective capacity of 16,000 tons of refined nickel per year before it shut down.

**Steel.**—Total steel products demand in the Philippines was 826,000 tons in 1986, the latest year for which official data were available. National Steel Corp., the country's largest steel producer, covered about 68% of the market. National Steel supplied about 97% of total demand for cold-roll sheets; 65% of the market for tinplate; 58% of the market for billets; and 57% of demand for hot-roll sheets.

## INDUSTRIAL MINERALS

**Cement.**—The Philippine cement industry, which in recent years had been operating at about 50% of capacity, was thrust to the brink of having to import after the Government initiated a $195 million housing-construction program and a $180 million roadbuilding program to boost the country's economy. The country's 13 operating cement factories—5 plants had closed in recent years—operated at near capacity throughout 1987.

**Fertilizer Materials.**—The phosphate fertilizer mine at Batinque on Leyte was closed temporarily in early 1987 owing to a shortage of working capital. As a consequence, Philippines Phosphate Fertilizer Corp. (Philphos) became entirely dependent upon imported phosphate rock from Nauru for the operation of its fertilizer plant at Batinque. Philphos had been blending impure Batinque rock with that from Nauru because the company claimed that Nauru rock alone was not fully suitable for the plant. Despite the high quality of Nauru rock, a better phosphate recovery could be obtained from blending both types of rock.

**Sulfur.**—Freeport-McMoRan Inc. of the United States and International Consultex (Philippines) Inc. were planning to open a joint-venture surface sulfur mine at Pamplona, Negros Oriental Province, Negros Island, in the central Philippines. The proposed project, depending upon the processing technology and the capacity, would cost between $50 million and $100 million.

## MINERAL FUELS

**Coal.**—Piedra Negra Mining Corp. (PNMC) discovered a high-grade coal deposit in the Tandag-Marihatag-Lianga coal basin in Surigao del Sur Province, northern Mindanao, estimated to contain 182 million tons. PNMC submitted to the Ministry of Energy a 5-year work program in which the company planned to produce 40,200 tons of coal during the second year of production, increasing to 93,000 tons by the fifth year. Both proposed production and the initial year of operation were unknown.

**Petroleum.**—Crude petroleum was produced from three oilfields—Cadlao, Malintoc, and Nido—during the year, accounting for about 5% of the country's requirements. Crude petroleum remained the country's largest single commodity import in terms of value, with Saudia Arabia the principal supplier. The Philippines had three oil refineries to process crude, but domestic consumption remained larger than these facilities could supply. There remained little interest in exploration for oil; only seismic surveys were made during the year.

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[1]Physical scientist, Division of International Minerals.
[2]Where necessary, values have been converted from the Philippine peso (P) to U.S. dollars at the rate of P20.6=US$1.00.
[3]American Metal Market. V. 95, No. 55, Mar. 23, 1987. p. 3.
[4]Chamber of Mines of the Philippines. CMP Newsletter. V. 13, No. 1, Jan. 1988, p. 3.
[5]Page 4 of work cited in footnote 4.
[6]American Metal Market. V. 96, No. 6, Jan. 11, 1988, p. 2.
[7]Far Eastern Economic Review (Hong Kong). V. 136, No. 14, Apr. 2, 1987, p. 8.

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